

CITY OF WHITEHORSE SERVICING STANDARDS MANUAL
PART 3 – CONSTRUCTION SPECIFICATIONS
SECTION 3.22 – LANDSCAPING

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3.22.1 SCOPE

This section outlines the requirements for placing and maintaining topsoil, seed, trees, shrubs, herbaceous plants, water, mulch, and fertilizer as shown on the plans or as directed by the Engineer. These standards are based on the B.C. Landscape Standard.

Design Criteria for Landscaping is outlined in Section 2.8.

3.22.2 DELIVERY, STORAGE AND HANDLING

3.22.2.1 GENERAL

Materials to be stored on site as directed and approved by the Engineer.

Protect all materials as required during transportation and storage.

3.22.2.2 WOOD FIBER MULCH AND TACKIFIER

Deliver wood fiber mulch and tackifier in moisture-proof containers indicating manufacturer, content, and net air-dry mass.

3.22.2.3 GRASS SEED AND NURSE CROP SEED, HYDRAULIC MULCH, FERTILIZERS AND RELATED MATERIALS

Deliver and store grass seed in original containers showing:

- Analysis of seed mixture
- Percentage of pure seed
- Year of production
- Net mass
- Date when tagged and location
- Percentage germination
- Name and address of distributor

Supply fertilizer to the contract site in shrink-wrapped or other suitable moisture proof containers, with the guaranteed chemical analysis clearly shown on each container.

Provide to the Engineer before, and as a condition of use, a shipping bill issued by the supplier of the material, designating the supplier, the manufacturer, the type of material, and a certification of the net weight or volume of material in each container.

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Seed is to be packed and delivered in original containers clearly showing name of supplier, analysis of seed mixture, percentage of pure seed, year of production, net weight (mass), date and location of bagging. Seed information from bags is to be cut out and delivered to the Engineer.

All grass seed and nurse crop seed, hydraulic mulch, fertilizers and related materials, are to be stored in a dry, weatherproof storage place and are to be protected from damage by heat, moisture, rodents or other causes until time of application. Labels or other identification are not to be removed or defaced. Take precautions to prevent damage of stored materials by vandalism or weathering.

Fertilizer is to be packed in standard waterproof containers, clearly marked with the name of the manufacturer, weight and analysis.

Any material which has become wet or otherwise damaged during delivery or storage, or does not meet the requirements specified is to be rejected and the Contractor is to immediately remove rejected material from the project area.

3.22.2.4 PLANTS

3.22.2.4.1 Transporting to Site

Dormant Plants

Deciduous: Bare Roots (only in dormant period or condition): Adequate protection is to be given to preserve moisture around the root system. For short transit period, 4 hours or less, maximum temperature in the truck should be not above 20° C. In all cases, at all times, roots should be protected from frost, wind and sun, by such means as a closed van with wet straw or other suitable material over the roots. Temperature is to be maintained as uniformly as possible by mechanical or other means, at all times, to prevent frost damage to roots. Appropriate temperature range is to be between 0° C and 10° C.

Evergreens: It is recommended that rootballs not be subjected to freezing temperatures below -5° C for a period longer than 4 hours and that adequate protection from wind and sun be given to prevent desiccation.

Non-Dormant Plants

Deciduous and Evergreens: Movement of container grown, B&B, and wire-basketed plants should be restricted to closed van or well-covered truck with mesh tarp or similar material to protect the leaves or needles from windburn. If plants will be in transit for more than three days, they should be unloaded at interim points and stored away from direct sun for 24 hours at each interim point to avoid burning. When plants may be subject to wind during transportation and storage, tarps and other protective measures may be supplemented by spraying the foliage with an antidesiccant before shipping.

3.22.2.4.2 Unloading Procedures

BR (Bare Root): Roots should be covered and protected immediately from frost, freezing, sun, and wind.

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Pots/Containers: Should be handled as much as possible by the container only to reduce breakage of branches or leaves.

Ball & Burlap: Handle with caution to maintain the firmness of the root balls. Protect against damage to stems and branches.

Trees should not be lifted by the trunk. Lift by attachments to the basket at three to four points or by supporting the tree below the rootball. Support the trunk as necessary to hold it in relation to the rootball and prevent tearing of roots or loosening of rootball. Support is to be such that the cambium is not damaged.

All plants should be unloaded and checked immediately upon arrival and should be watered if necessary. The supplier should be notified of any plant damage as soon as possible.

Plant material is not to be dropped or handled roughly.

3.22.2.4.3 Handling and Storage

Plants are to be kept in a moist condition at all times. All plants are to be well protected against damage, extreme temperatures and desiccation.

During loading, transportation, off-loading, and planting, all trees should be protected against damage to stems and branches. This applies particularly to large wire-basketed trees.

Bark should be protected against chafing from chains, cables, equipment, or other trees by a wrapping of cardboard or burlap.

Sudden or rapid movement of trees in transit or off-loading should be avoided. If the tree's branches are entangled with those of other trees, care should be taken to separate them without damage to branches.

If damage occurs, it is to be reported to the Authority. If the Authority determines that the plant is acceptable despite the damage, proper corrective measures should be carried out in accordance with arboricultural practices recognized by the International Society of Arboriculture.

Shattered bark should be removed and broken branches should be pruned back to the appropriate branch collar or bud, with care to avoid tearing of the stem bark. Wounds should be traced to a clean, generally elliptical opening as recommended by the International Society of Arboriculture. .

During Growing Season all plants in containers, B&B, or wire basket, if not planted immediately, are to be stored in an upright position, and care should be taken to provide enough space between plants so that light reaches all around to the bottom of the plant in order to avoid sunscald or burning when plants are planted out.

For balled & burlapped plants special attention should be given to the rootball, and unless weather is rainy or cool, balls are to be protected by heeling-in into material suitable to protect them from drying out. (Examples: sawdust, peat moss, topsoil). Plants intended to be planted in the open are not to be

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kept stored in a building or any area of low light intensity for a period exceeding 7 days. All plants are to be kept well watered and protected from extreme temperatures.

For containerized plants in extreme weather, freezing or high dry heat, the containers are to be covered in a protective medium such as sawdust, peat moss or topsoil. Plants intended to be planted in the open are not to be kept stored in a building, truck, or any area of low light intensity for a period exceeding seven days during the growing season.

Plants are to be acclimatized or "hardened off" against the environmental conditions of their final planting location, and are not to be taken directly from the greenhouse and planted in a drastically different environment. Preparation for the new environment should include an appropriate period of storage in an intermediate environment, managing fertilizer applications to avoid excessively lush growth, and a graduated watering regime.

3.22.3 MATERIALS

3.22.3.1 TOPSOIL

Topsoil is to be required, as specified by the Engineer, where native soils are not capable of sustaining the intended vegetation.

Topsoil is to be a natural, fertile agricultural soil capable of sustaining vigorous plant growth. It is to be free of subsoil, clay lumps, wood including woody plant parts, weed or reproductive parts of weeds, plant pathogenic organisms, stones over 30 mm and other extraneous matter.

3.22.3.1.1 Sampling – Existing Soil

The Developer's Contractor is to supply a sample of topsoil to an independent laboratory for analysis from each designated source to be used.

A minimum of five samples should be taken from representative areas of the site. Where soil conditions vary considerably over the site, a minimum of five samples are to be taken from each distinct soil type or area on the site.

Samples are to be taken from the surface horizon only, to a depth of no more than 30 cm. Samples should be approximately 625 ml (2 1/2 cups) in volume.

Samples are to be placed in paper bags clearly numbered and labelled as to location on the site.

3.22.3.1.2 Sampling – Imported Topsoil

The Contractor is to provide the Engineer with a comprehensive soil test for any supply of imported topsoil. The test results must be dated no earlier than 90 days prior to placement. The test must include macronutrient content (N, P, K and S), electrical conductivity and pH. Test results furnished by the topsoil supplier are acceptable provided that they have been conducted by a nationally certified laboratory facility.

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If such a test result is not available, a minimum of two samples are to be taken for testing from representative areas of the topsoil supply. Samples are to be gathered and packaged as above.

3.22.3.1.3 Testing

The laboratory analysis is to be forwarded to the Engineer within 72 hours of receipt by the contractor and is to include tests for pH, Nitrogen (N), Potassium (P), Phosphorus (K), Sulphur (S), minor element values, soluble salt content, electrical conductivity, and physical values (particle size analysis or soil textural class) and organic matter.

Samples are to be tested at a nationally certified laboratory facility, typically:

Norwest Labs
9938 - 67th Avenue
Edmonton, AB T6E 0P5
Phone (780) 438-5522 or 1-800-661-7645
Fax (780) 434-8586
www.norwestlabs.com

Abnormal readings for existing soils (i.e. excessive alkalinity) that may affect seed or plant material establishment must be reported immediately in writing to the Engineer so that appropriate species substitutions can be made.

Physical Specifications:

- Topsoil conforms to physical grading of sandy to clay loam
- Sand maximum 50% by dry mass
- Clay maximum 50% by dry mass
- Organic material Seeded areas – 3 to 5% by dry mass
- Planting beds – 15 to 20% by dry mass

Chemical Specifications:

- Topsoil is to contain no toxic materials
- Electrical conductivity is to be 3-4 mhos per cm²
- pH is to be 6.0 to 7.5

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3.22.3.1.4 On-site Topsoil

The use of on-site topsoil is encouraged, if it meets the standard set for imported growing medium and can be modified to meet the requirements set out for growing medium. Topsoil is to be defined as the existing "A" horizon containing accumulated organic matter, and can usually be distinguished by a darker coloration. Soils lacking in organic matter and consequently not desired for growing medium will be recognized by a lighter coloration for the "B" and "C" horizons of the soil profile. Please note that native soils in the Whitehorse area are most often insufficient for planting of other than naturalized areas.

Where on-site topsoil is deemed sufficient, all areas of the site designated for paving, or the construction of structures, is to be stripped of all topsoil and organic matter.

Topsoil is to be stripped to its full depth, taking care not to mix topsoil with subsoil. Subsoil may be considered for use provided that additional organic matter is available, soil structure is acceptable, and a soil test is done of the amended product prior to placement.

Topsoil stripping is to be commenced after the area has been cleared of all scrub, plants, weeds, grass, stumps, rocks 100 mm and over, and other extraneous materials. Such materials are to be removed from the site.

If testing shows it to be suitable for growing medium, a sufficient quantity of stripped topsoil is to be stockpiled where shown on drawings or in areas designated for stockpiling according to construction planning and scheduling.

Topsoil is not to be moved or worked while in a wet or frozen condition or in any manner in which the soil structure is adversely affected.

3.22.3.1.5 Imported Topsoil

Imported topsoil is to be a natural, fertile agricultural soil capable of sustaining vigorous plant growth. Topsoil is to be virtually free from subsoil, wood including woody plant parts, weed or reproductive parts of weeds, plant pathogenic organisms, toxic materials, stones over 30 mm, and foreign objects.

The Contractor is to supply topsoil samples and test results as required in Section 3.22.3.1.3. Test results for imported topsoil are to fall within acceptable ranges. Where one or more parameters are shown to be unacceptable, the Engineer may require suitable amendments be made to the soil to render it acceptable or that another topsoil supply be used.

Imported topsoil is to conform to textural class grading of sandy loam to clay loam and meet the following physical specifications:

- Sand: Maximum 50% by dry mass
- Clay: Maximum 50% by dry mass
- Organics: Seeded areas – 3 - 5% by dry mass

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- Planting beds – 15 - 20% by dry mass

3.22.3.2 SEED

3.22.3.2.1 Classes

Establishment of grass can occur in a range of conditions from highway and industrial use to fine residential-type lawns. The following three classes and corresponding standard characteristics are recommended for designating the standard required for a particular project or area:

3.22.3.2.1.1 Class 1 Areas (Lawn):

- Uses: High profile building sites, areas around public entrances to buildings of lower profile, small urban and suburban sites. This is the minimum standard for residential and commercial areas.
- Usual Maintenance Level: Groomed.
- Growing Medium: Topsoil to minimum 150 mm depth or as specified.
- Gradient Standards: As specified. Grade irregularities should be minimal.
- Drainage: Collected and dispersed via standard means: storm sewer, etc.
- Seed: As specified; Certified Canada No. 1.
- Sod: As specified; typically No. 1 Premium or No. 2 Standard or comparable.

3.22.3.2.1.2 Class 2 Areas (Grass):

- Uses: Large suburban sites, public areas around large facilities with park-like conditions, industrial sites.
- Usual Maintenance Level: Moderate.
- Soil: As specified.
- Gradient Standards: As specified. Minor grade irregularities are acceptable if ponding is not created.
- Drainage: Collected and dispersed via standard means: storm sewer, etc.
- Seed: As specified; Canada No. 1 lawn seed.
- Sod: As specified; typically No. 3 Commercial or comparable.

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3.22.3.2.1.3 Class 3 Areas (Rough Grass/Naturalized):

- Uses: Rural sites, verges of airport runways, highway rights-of-way, and temporary grass cover.
- Usual Maintenance Level: Low.
- Soil: Existing soil cleaned by mechanical means of surface debris over 50 mm in any dimension or as otherwise specified.
- Gradient Standards: As specified. Roughly graded for ease of maintenance and positive surface drainage.
- Drainage: Collected and dispersed via standard means or held in an area intended for ponding.
- Seed: As specified. Seed should be selected to suit soil, maintenance and climate conditions. This may include wildflower seeds in a “naturalization” mix.

3.22.3.2.2 Grass Seed

Grass seed is to meet the requirements of the Canada Seed Act for Certified Canada No. 1 Seed.

Where specified, all nurse crop seed is to meet the requirements of the Canada Seed Act for Certified Canada No. 1 Seed.

Seed mixtures are to be suited to the climate, orientation and sun exposure, terrain, establishment and maintenance conditions under which they are to be grown. Seed mix composition is to be as specified. Where not specified, professional consultation is recommended in selecting or designing seed mixtures.

Seed is to have minimum germination rate of 75% and minimum purity of 97%, except where otherwise required by the Engineer or the professional selecting the seed mixture.

The mixture is to be mixed and supplied by a recognized seed house.

The City may require testing of seed for purity and germination at the Contractor’s expense.

Class 1 & 2 Area seed mix is to be specified by the Engineer.

Seed mix for Class 3 Areas is to be as specified below, or an approved equal.

Botanical Name	Common Name	Variety	Kg/ha
Agropyron riparium	Streambank wheatgrass	Sodar or Common	9
Agropyron trachycaulum	Slender wheatgrass	Revenue, Adanac or Highlander	18
Festuca rubra	Creeping red fescue	Boreal	12
Festuca ovina	Sheep fescue	Common	12

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Poa compressa	Canada bluegrass	Canon	9
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Seed mix is to be seeded at a rate of 60 kg per hectare.

Mixes are to ensure the absence of *Sonchus arvensis* (Perennial sow thistle) and *Linaria vulgaris* (Toad flax).

3.22.3.3 TURF GRASS SOD

Turfgrass sod is to meet the requirements of the B.C. Landscape Standard for Turfgrass Sod or other comparable Canadian standard.

3.22.3.4 FERTILIZERS

Fertilizers are to be standard commercial brands, meeting the requirements of the Canada Fertilizer Act.

All fertilizers are to be in granular, pelleted or pill form, and are to be dry and free flowing.

The fertilizers are to have a guaranteed N-P-K analysis.

The types, formulations, and rates of application for fertilizers are to be as recommended by the laboratory soil specialist on the basis of tests of the growing medium, and as approved by the Engineer.

Substitutions or variations in fertilizers and methods are to be made only with the approval of the Engineer.

Receipts and empty fertilizer bags should be retained until reviewed by the Engineer as verification that the required fertilizer has been applied.

Use of fertilizer will be dependent on the results of the soil testing particularly on native soils.

Fertilizer is to conform to the following:

- Root Starter- granular water-soluble fertilizer 10-6-4 or 20-20-20
- Supplementary organic 11-48-0 or
- Fertilizer - ureaform or slow-release ammonium nitrate if available

The fertilizer is to be a complete fertilizer applied at the rate of 500 kg/hectare 16-20-0 (14) (NPKS) + 50 kg/hectare 0-0-60 (NPK).

Alternate mixes providing the same level of nutrients will be considered and must be approved by the Engineer prior to supply. The Contractor may be required to apply substitute fertilizer at a higher rate to ensure the minimum required levels of all nutrients are met.

Fertilizer is to be of the type to permit complete suspension of the insoluble particles in water for application by power spray equipment.

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3.22.3.5 HYDROSEEDING TACKIFIER / BINDER

Use binder compatible with the mulch at a rate sufficient to mix consistent slurry.

Binder is to be mixed and supplied by a recognized seed supplier and is to have tested rates of purity.

The tackifier is to be a free flowing non-corrosive biodegradable organic powder produced from a natural plant gum or approved equivalent.

3.22.3.6 HYDROSEEDING HYDRAULIC MULCH

Hydraulic mulch, when used, is to consist of fiber or other material designed for hydraulic seeding and dyed for ease of monitoring application.

Hydraulic mulch is to be capable of dispersing rapidly in water to form a homogeneous slurry and remaining in such a state when agitated or mixed with other specified materials. When applied, the hydraulic mulch is to be capable of forming an absorptive mat, which will allow moisture to percolate into the underlying soil. It is to contain no growth or germination inhibiting factors. The mulch is to be dry, be free of weeds and all other foreign material, and is to be supplied in packages bearing the manufacturers label clearly indicating weight and product name.

The mulch may contain a colloidal polythacuride (or equivalent) tackifier that is to be adhered to the mulch to prevent separation during shipment and to avoid chemical agglomeration during mixing in hydraulic mulching equipment.

Material is to be wood cellulose fiber containing no contaminants.

Fiber is to be supplied by a recognized supplier and is to have a certified weight and composition.

The material used for mulching is to be natural wood fiber or specially processed wood fiber specially prepared for use in hydroseeding equipment, and of a type approved by the Engineer. It is to contain no growth or germination inhibiting factors and is to form after application a blotter-like ground cover, which will allow absorption and percolation of water.

Mulch material is to contain a non-toxic water activated green coloring.

Mulch material is to have properties enabling it to be evenly dispersed and suspended when agitated in water.

Minimum application rate is 1500 kg per hectare (if a tackifier is not already incorporated into the mulch, it is to be added during hydroseeding at a rate of 45 kg/hectare).

3.22.3.7 ORGANIC COMPONENTS

Peat moss is to be horticultural grade, partially decomposed fibrous or cellular stems and leaves of Sphagnum Mosses. Peat moss suitable for horticultural purposes should be medium to coarse shredded with a texture varying from porous to spongy fibrous, fairly elastic and substantially homogeneous with a pH value of not less than 3.5 and not greater than 6.5.

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Manure is to be well-rotted farm animal manure, rotted to the extent that the material is crumbly. Manure is to be free from weed seeds, rocks, sticks, and rubble and is to contain not more than 40% sawdust, straw or shavings. Total carbon to nitrogen ratio in the resulting growing medium is not to exceed 40:1.

Commercially prepared compost is to be virtually free from all viable weed seeds, or other plant reproductive parts, coliform, pathogens, and chemical or toxic contaminants. Physical contaminants such as rocks, plastic, metal or glass are to be less than 0.5%. Total carbon to nitrogen ratio in the resulting growing medium is not to exceed 40:1.

Animal manure and compost often provide excessive levels of water-soluble salts. Before planting, the growing medium is to be leached with fresh water from irrigation or precipitation until an electrical conductivity of 3.0 mmho/cm or less is achieved.

3.22.3.8 WOOD RESIDUALS

The use of uncomposted wood chips, bark, sawdust, and ground green wood is not permitted. Yukon soils are typically deficient in nitrogen and the decomposition of carbon-rich woody materials can further deplete the soil of nitrogen.

3.22.3.9 SAND

Sand is to be clean river sand, or locally available equivalent, free from impurities, chemical or organic matter. Particle size in sand is to be such that:

- 95-100% pass a USBS No. 4 (4.76 mm) standard sieve
- 0-40% pass a USBS No. 35 (0.5 mm) standard sieve
- 0-5% pass a USBS No. 270 (0.053 mm) standard sieve

The percentage of fines (silt and clay) is defined as mineral matter passing through a USBS No. 270 sieve.

3.22.3.10 OTHER GROWING MEDIA

A growing medium is any soil, soil substitute, or mixture that's chemical and physical properties fall within the ranges required for proper plant growth (i.e. potting mix for container plants).

Growing media is to be virtually free of plants or their roots, sticks, building materials, wood chips, chemical pollutants and other substances at levels toxic to plants, and other extraneous materials that detract from the desirable physical and chemical properties for landscaping purposes.

Death of plants during the first year that can be attributed to plant pathogenic organisms or toxic materials in the growing medium may be an indication that the growing medium did not meet this requirement at the time of installation, and may result in a requirement that the Contractor remove and replace dead plants and faulty growing media.

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Excessive growth of weeds in a growing medium during the first year may be an indication that unacceptable levels of weed seeds or weed parts were present in the growing medium at the time of installation. Such a determination may result in a requirement that the Contractor remove all weeds and weed roots and reduce the growth of weeds to acceptable levels.

Soils intended for revegetation, restoration or naturalization areas might contain roots and wood debris that is considered unacceptable for other uses.

3.22.3.11 WATER

Water used in hydraulic seeding and irrigation is to be free of any impurities that may have an injurious effect on the success of seeding or germination, or may be harmful to the environment.

3.22.3.12 PLANTS

All plant material is to be obtained from a supplier located within zone 3 rusticity rating or lower. Plant selection is subject to engineer approval.

3.22.3.12.1 Pertinent Standards

- Canadian Nursery and Landscape Association; Canadian Standards for Nursery Stock
- ANSI Z-133-I; American Standards for Tree Care Operations
- ANSI A-300; Tree Pruning Guidelines
- Perennial Plant Association Standards for herbaceous perennial plants.

3.22.3.12.2 CNLA and BCNLA Standards

The requirements of the Canadian Standards for Nursery Stock is to apply except as and where modified by the requirements of the British Columbia Landscape Standard.

3.22.3.12.3 Planting Bed Preparation

The Contractor is to excavate planting beds to a depth of 500 mm below finished grade, scarifying the remaining subsoil to a depth of not less than 50 mm. The Contractor is to remove all existing turfgrass, weeds, roots, stones larger than 50 mm in diameter, and all other foreign matter from the surface of the subsoil prior to placing topsoil in bed areas.

The topsoil is to be uniformly spread to minimum compacted depth of 500 mm in planting beds. Ensure plant material is installed in slight depression relative to surrounding area to maximize on water retention during irrigation.. Topsoil is to not be placed when either the topsoil or the subsoil is frozen, excessively wet, extremely dry, or otherwise in a condition detrimental to proper grading, compaction or cultivation.

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Where soil amendments are required as indicated by the soil tests, they are to be applied and worked into the soil prior to the application of topical fertilizers.

Topsoil is to be compacted to 85% Standard Proctor Density.

3.22.3.12.4 Plant Materials

Specimen plants should be identified in the plant list. This designation is usually applied to large trees and shrubs, and may be used to indicate exceptionally heavy, well-shaped plants. Plants designated as Specimen or plants having other unique desirable characteristics should be pre-selected, or the required special characteristics (such as unique branching habit, deviations from standard minimum caliper, height, branching height, rootball size, foliage density) should be clearly specified. Specimen plants or plants having unique desirable characteristics may be pre-purchased or incorporated by other special agreements.

All nursery-grown plants are to, as a minimum, comply with the Canadian Nursery and Landscape Association Canadian Standards for Nursery Stock and the BCNLA Standard for Container Grown Plants with respect to sizing, grading and quality. The requirements of the Canadian Standards for Nursery Stock is to apply except as and where modified by the requirements of the British Columbia Landscape Standard.

Native plants are to be propagated in nurseries and not taken from wild sites, except where salvaged from an area where the native vegetation will be destroyed for other reasons.

All collected native plants are to be held and maintained in a nursery until new roots have formed through the burlap or other suitable packing material, or in the case of containerized plants, until such time that the roots grow to fill and hold the soil within the container.

All plants specified "Container" are to be grown for the length of time necessary to permit the roots to fill and hold the soil within the container, as required by Canadian Nursery and Landscape Association Standards for Nursery Stock.

Plants are to be true to name, type and form, and representative of their species or variety. Plants are to be compact and properly proportioned, not weak or thin, or injured by being planted too closely in nursery rows. In particular, conifers are to have a healthy single leader (unless intended for a hedging form) and overall natural form characteristic of the species or variety. The leader is to have well-spaced whorls of vigorous newly growing branches, such that proper development of the plant's form can be expected.

Plants are to have normal, well-developed branches and vigorous, fibrous root systems. They are to be healthy, vigorous plants, free from defects, decay, disfiguring roots, sunscald injuries, abrasions of the bark, plant diseases, insect pests' eggs, borers and all forms of infestation.

Groundcover plants are to have healthy tops to a size proportionate to the above root requirements typical of the species or variety.

Rootballs and soil in containers are to be free from pernicious perennial weeds.

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There are to be no substitutions of plants without prior written approval from the Reviewer. (Note that in many instances it may be necessary to obtain approval of substitutions from the municipal or other Authority.)

3.22.3.12.5 Rootballs

Quality must be normal for the species when grown under proper cultural practices. Fertile soil, ample spacing, weed control, pest control, adequate moisture, pruning and shearing, transplanting or root pruning not less than once in four years, depending on species, are all necessary requirements for normal quality nursery stock. All nursery stock must be viable, free from pests and disease, and undamaged.

All nursery stock must have an adequate fibrous root system that has been developed by proper cultivating practices, particularly transplanting or root pruning. Pertinent facts, such as to when larger nursery stock was transplanted or root pruned, must be available to the buyer.

Rootball sizes should always be of sufficient width and depth to encompass enough of the fibrous and absorptive root system to enable full recovery of the plant.

Balls must be solid, remain intact until transplanted, and be tied tightly with burlap and rope.

Larger rootballs than those recommended are required when the plants have not been transplanted or root pruned for four or more years or when plants are dug out of season.

The Canadian Nursery and Landscape Association Canadian Standards for Nursery Stock, includes:

- standard container sizes
- digging standards
- rootball diameters, depths, weights
- recommended container sizes by plant type
- height relationship to caliper by type.

Securing Rootballs over 60 cm: Rootballs over 60 cm are to be secured with either daisy baskets or wire baskets or drum tied with twine or rope. Tying material and burlap are to not be wrapped around the trunk or collar of the tree.

Securing Rootballs under 60 cm: Rootballs below this size are to be secured with either poly twine or treated sisal with a maximum of 10 cm between wraps and have a lateral line around the centre of the ball at right angles to the regular ties. Tying material and burlap are to not be wrapped around the trunk or collar of the tree.

Rootball Sizing: Tables 9-1 and 9-2 show minimum sizes for root balls for coniferous and deciduous trees. This does not however preclude the fact that rootball sizes could be larger for certain applications.

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Other methods of securing Rootballs: There are many products coming on to the market each year, for example, wire mesh, for securing rootballs. All methods of treating rootballs must follow the guidelines provided for in this standard, even if not specifically mentioned.

Current practices in parts of Canada include the using "grow bags" and pre-digging trees then heeling them into sawdust for several months to develop fibrous roots. Digging, preparation and transplanting are to be such that the fibrous roots are well developed and are protected. Trees are to be suited to establishment after planting, without undue setback, and without "dieback". See Canadian Nursery and Landscape Association Canadian Standards for Nursery Stock most recent edition.

3.22.4 INSTALLATION

3.22.4.1 WEED CONTROL

The Developer is to be responsible for the control of existing weeds and all subsequent weed growth within the site or sites. Weed control is to be carried out when the density of weeds reaches 25 broad leaf weeds per 100m². Weed control, whether manual or chemical, is to reduce the quantity of weeds to zero.

3.22.4.2 SUBSOIL PREPARATION

All weeds, roots, stones larger than 50 mm in diameter, and all other foreign matter are to be removed from the surface of the subsoil. Immediately before placing topsoil, the subsoil is to be loosened to a depth of not less than 50 mm by a disc or other means satisfactory to the Engineer.

3.22.4.3 EXCAVATION

In the event mechanical tree digging equipment cannot maintain a minimum clearance of 1.0 m from shallow utilities during installation, the pertinent Utility must be contacted for approval and/or safety procedures. Any additional costs incurred will be at the Developer's expense.

3.22.4.4 FINISH GRADE PREPARATION

The finished grade is to be smooth to the extent required for the class of seeding or sodding to be carried out, firm against footprints, loose textured, and free of all stones, roots, branches, etc. larger than the diameter required for removal for the class of seeding or sodding to be carried out.

For information on Lot Grading requirements, refer to Section 2.11 of this manual.

Areas that are excessively compacted are to have their surfaces loosened by means of a thorough scarification, disking or harrowing, to a minimum of 150 mm depth.

Before commencement of seeding or sodding operations, approval of site preparation should be obtained from the Engineer.

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3.22.4.5 PLACING TOPSOIL

The topsoil is to be uniformly spread to a minimum compacted depth of 150 mm, except in planting areas where it will be to a depth of 500mm. Topsoil is not to be placed when either the topsoil or the subsoil is frozen, excessively wet, extremely dry, or otherwise in a condition detrimental to proper grading, compaction or cultivation.

Where the addition of soil amendments to correct pH is required as indicated by soils tests, such amendments are to be applied and worked into the soil prior to the application of fertilizers, and in sufficient quantities to obtain a pH value of not less than 6 and not greater the 7.5.

Once topsoil has been placed, the area should be thoroughly disked, harrowed, and floated to a depth of 75 mm. All hard lumps are to be broken down and all stones larger than 50 mm in diameter, as well as roots, stumps and all other foreign matter are to be removed and disposed of.

Topsoil is to be compacted so as to be a firm seed bed resistant to footprints deeper than 25 mm.

3.22.4.6 FERTILIZING

Approved fertilizer is to be applied with an approved spreader at a rate of 50 kg per 1000 m², and is to be well worked into the top 75 mm of soil by disking and harrowing. The finished surface is to be loose, textured, and even.

3.22.4.6.1 Supplementary Fertilizing: Seeding

6 weeks after germination, the area is to receive a supplementary application of an organic fertilizer such as 27-14-0 at rates determined by soils tests.

3.22.4.6.2 Supplementary Fertilizing: Sod

4 weeks following sod installation, the area is to receive an application of an organic fertilizer such as 27-14-0 at rates determined by soils tests.

3.22.4.7 SEEDING

3.22.4.7.1 Base Preparation – Seeding or Sodding

Areas to be seeded or sodded are to be loosened to a depth of not less than 50 mm by a disc or other means satisfactory to the Engineer. The Contractor is to remove all disturbed turf grass, weeds, roots, stones larger than 50 mm in diameter, and all other foreign matter from the surface of the soil prior to placing topsoil and seed or sod.

Once topsoil has been placed, the area to be seeded or sodded should be thoroughly disked, harrowed and floated to a depth of 100 mm. All hard lumps are to be broken down and all stones larger than 50 mm in diameter, as well as roots, stumps and all other foreign matter are to be removed and disposed off-site.

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The Developer is to obtain the Engineer's approval of the seedbed prior to proceeding with seeding.

3.22.4.7.2 Seed Placement

Seeding is to be carried out during periods that are most favorable for the establishment of a healthy stand of grass. All seeding is to be done during calm weather and on soil that is free of frost, snow, and standing water, when seasonal conditions are likely to ensure successful germination and continued growth of all species of seed in the grass mix. Unless otherwise specified, seeding is to not take place prior to June 1st or after September 15th of any given year.

Seeding is not to be carried out when wind velocities are above 8 km/hr.

Seed is to be applied by one of Method A (Mechanical Dry Seeding) or Method B (Hydraulic Seeding) unless otherwise specified. Hand seeding is not recommended, and is to be carried out only when site conditions preclude the above two methods.

Rates of application of fertilizers, seed mixtures, mulch and other components are to be based on an analysis of the season, climate, terrain, soil, and establishment and maintenance conditions affecting the project.

For slopes flatter than 3:1, seeds are to be sown at a rate of 24 kg per 1000 m² in two passes of the mechanical spreader perpendicular to each other.

3.22.4.7.2.1 Method A: Mechanical Dry Seeding

The required fertilizer is to be uniformly applied at the rate required and worked well into the topsoil by disking, raking, or harrowing to a minimum depth of 50 mm.

Seed is to be applied by means of an approved mechanical dry seeder at the rate required.

Seed is to be applied in two intersecting directions, except where conditions dictate seeding in one direction only.

All grass seed, nurse crop seed and fertilizer are to be measured accurately before being applied.

Seeded areas (particularly for Class 1 Lawns and smaller areas) should be lightly raked and rolled after seeding to ensure good contact between seed and growing medium.

Mulch may be applied (particularly for Class 2 and 3 Grass areas and larger areas) with seed or following seeding with an approved mulcher. No area is to be seeded more than that can be mulched on the same day. The mulch is to be applied to form a uniform mat over the entire area.

3.22.4.7.2.2 Method B: Hydraulic Seeding

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The quantities of each of the materials to be charged into the hydraulic seeder/mulcher tank is to be accurately measured either by mass or by a commonly accepted system of mass-calibrated volume measurements. The materials are to be added to the tank while it is being filled with water and in the following sequence: seed, fertilizer, and where applicable, mulch. The materials are to be thoroughly mixed into a homogeneous water slurry in the various combinations described herein, and are to be distributed uniformly over the surface area with the hydraulic seeder/mulcher.

All hydraulic seeding/mulching equipment is to have the tank volume certified by an identification plate or sticker that is to be affixed in plain view on the equipment and is to not be removed or altered.

The tank should be thoroughly cleaned prior to any and all seeding applications.

The hydraulic seeder/mulcher is to be capable of sufficient agitation to mix the materials into a homogeneous slurry and to maintain the slurry in a homogeneous state until it is applied. The discharge pumps and gun nozzles are to be capable of applying the materials uniformly over the designated areas.

After charging, water or other material is not to be added to the mixture in the hydraulic mulcher.

Seed, fertilizer, mulch and water slurry are not to be left in the tank for more than four hours. Slurry left in the tank over the maximum time is not to be used for seeding and is to be disposed of off-site.

Wildflower seed, if required, should be applied following grass hydraulic seeding.

Hydraulic seeding is to be done with care to ensure that fertilizer in solution does not come in contact with the foliage of any trees, shrubs, or other susceptible vegetation. Seed or mulch are not to be sprayed on objects not expected to grow grass.

Existing site equipment, roadways, landscaping, reference points, monuments, markers and structures are to be protected from damage.

Any overspray or damage that occurs during hydraulic seeding is to be promptly rectified.

3.22.4.8 HYDRO-SEEDING

For slopes steeper than 3:1, a hydro-seeder of approved design capable of thoroughly mixing water, grass seed, fertilizer and pulverized wood fiber is to be used. The hydro-seeder is to be accurately charged with materials at the following rates:

- Grass seed 24 kg/1000 m²
- Water 468 L/1000 m²
- Mulch 50 kg/1000 m²

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In lieu of using a hydro-spreader, seeding may be done as in Section 3.22.3.6.2. However, the seeded slope is to be protected with jute mesh, burlap, or approved equal, adequately fastened to the topsoil surface to prevent erosion.

3.22.4.8.1 Equipment

Equipment for hydroseeding, mulching and fertilizing is to be capable of mixing the seed, fertilizer, mulch, and tackifier as herein described, and evenly distributing the mixtures for efficient treatment of the selected areas.

The equipment is to have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix a slurry of materials in the amounts specified

The slurry tank is to have working capacity of at least 4500 litres, and the pump is to be capable of maintaining a continuous, nonfluctuating stream of solution. Distribution lines are to be of large enough diameter to prevent blockage, and the discharge lines are to be equipped with appropriate nozzles.

The equipment is to be capable of hydroseeding to the extremities of all areas designated for hydroseeding.

3.22.4.8.2 Measurement

The carrying capacity of water for natural wood fiber mulch is to be 45 kg/1000 L.

The amount of material to be used in each tank load and the area covered per tank load is to be calculated utilizing the carrying capacity noted above and the size of the slurry tank. A copy of calculations is to be provided to the Engineer for approval prior to commencing hydroseeding.

3.22.4.8.3 Application

Thoroughly mix seed, fertilizer, mulch, and tackifier uniformly distribute the mixture by means of an approved hydroseeder over the area designated by the Engineer.

Apply mulch material, with a minimum of 3% tackifier, at a rate of 1500 kg/ha of plan area.

Hydroseed under calm conditions and on ground free of frost, snow, ice, and standing water.

Measure the calculated quantities of each of the materials to be charged into the hydroseeder, either by mass or by a system of mass-calibrated volume measurement approved by the Engineer, and provide all equipment required for this purpose.

After charging, do not add water or other material to the mixture in the seeder tank.

Discharge the slurry mix completely and evenly over the entire area bounded by the marker stakes.

Seed and fertilize by other approved methods, areas that are inaccessible or otherwise designated by the Engineer. Distribute the material uniformly at the rates specified.

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A hydro-seeder of approved design is to be capable of thoroughly mixing water, grass seed, fertilizer, and pulverized wood fiber mulch in a slurry suitable for spraying onto the ground.

3.22.4.8.4 Watering of Seed

Under conditions that are not beneficial to good germination rates, watering may be required. Watering is to be carried out, when required, with sufficient quantities to prevent grass and underlying soil from drying out. Watering is to be done with a fine spray, which will not create any erosion problems as evidenced by rills.

3.22.4.9 SODDING

Sod is to be installed on slopes steeper than 2:1, or as stated on the plans and as shown on the specifications.

3.22.4.9.1 Subsoil Preparation

On slopes less than 2:1, the subsoil is to be prepared as specified in Section 3.19.3.2.

On slopes steeper than 2:1, mesh (plastic, geoweb, jute or hemp) is to be placed on the prepared subsoil. The mesh is to be placed with the long dimension running from the top to the bottom of the slope and secured with wood slats, a minimum of 12 mm x 50 mm and 450 mm long at intervals of 4.8 m down the slope and 2.0 m across the slope.

3.22.4.9.2 Sod Installation

Sod is to be laid evenly in staggered rows and is to be closely butted together. The edges of newly laid sod is to be matched to existing grades of surrounding grass or cultivated areas.

The sod is to be dressed to fill voids between sod strips, and on all areas having slopes less than 3:1, is to be rolled with a 90 kg to 114 kg light roller to provide close contact between sod and topsoil and to produce a smooth and even surface.

Sod is to be laid at right angles to the slope along the contours of the slope. On slopes greater than 2:1, wooden slats, 12 mm by 50 mm and 225 mm long is to be installed at intervals of 1.0 m. Wooden slats are to be driven fully into the sod.

3.22.4.9.3 Watering of Sod

Upon completion of sodding, the Developer is to apply water in sufficient amounts to saturate the sod and upper 75 mm of soil.

After sod and soil have dried sufficiently to prevent damage, the area is to be rolled with a roller, providing sufficient pressure to ensure a good bond between sod and soil.

Upon completion of rolling, the Developer is to apply water in the form of a fine spray sufficient to saturate the sod and the top 75 mm of soil.

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Watering is to be carried out as and when required to prevent grass and underlying soil from drying out, for a period of 10 days after installation.

The Developer is to arrange with the Engineer for the placement of a water meter onto all hydrants in use. The Developer is to be required to purchase from the Engineer all water used from the City distribution system on the project. Unless authorized in writing by the Engineer, the Developer is to not use any private or commercial development for obtaining water for maintaining the seed or sod due to the possibility of contamination.

3.22.4.10 PLANTING NURSERY STOCK

All plant material will be planted to original soil depth, ensuring that all burlap (in case of B&B stock) is removed from around the trunk of tree. The plant will be installed at a depth that is 300-600mm lower than the surrounding area to form a slight depression to capture water during irrigation.

All mulch material is to be kept away from the trunk.

Staking, when required, will be placed in the predominant wind direction at a height of approximately 1.25m above ground.

3.22.4.11 LANDSCAPING FABRIC

All fabric, used to reduce the growth of weeds, in planting areas or under gravel surfaces is to be a woven commercial grade quality product. During installation, where fabric overlap occurs, there is to be a 12 inch minimum overlap. Along edges with borders, particular attention is to be paid to create folds to ensure fabric remains in contact with edging material when wood or gravel mulch is installed.

3.22.5 REPAIR AND MAINTENANCE

3.22.5.1 INTENT

The intent of establishment maintenance is to provide sufficient care to newly installed plant material for a relatively short period of time to ensure or increase the long-term success of the planting. The objective is the adaptation of plants to a new site in order to obtain the desired effect from the planting while reducing the rate of failure and unnecessary work associated with improper establishment.

Establishment maintenance procedures apply to all vegetation, including: cultivated turf grass, revegetated or naturalized grass and wildflowers, existing and new trees, and shrubs and groundcovers

3.22.5.2 MAINTENANCE GUARANTEE

Maintenance guarantees and establishment maintenance requirements vary by project and according to the material in question. As a minimum, establishment maintenance procedures should be applied to turf and naturalized areas until material has reached “second cut” stage or equivalent and to shrubs and trees until full leaf-out the season following planting. Refer to project-specific contract documents for maintenance guarantee particulars.

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3.22.5.3 FIELD REVIEWS

In addition to the field review at the end of the guarantee period, there should be a minimum of two other field reviews during the first growing season attended by the Contractor and the Engineer. The Contractor should maintain a logbook of field reviews.

3.22.5.4 SCHEDULING

Maintenance operations are to be carried out in a predetermined schedule suited to the climate and local growing seasons. The Contractor is to provide the Engineer with a copy of the proposed establishment maintenance schedule for review upon request.

3.22.5.5 EXECUTION

3.22.5.5.1 Establishment Maintenance of Grass Areas

Watering: Hoses and sprinklers, irrigation systems or other methods are to be used to apply water to Class 1 and Class 2 grassed areas such that the grass is maintained in a turgid condition.

The method of application is to be such that compaction or erosion of the soil does not occur.

Watering is not usually required in Class 3 areas; however it may be required to prevent plant loss or deterioration under drying conditions.

Each application of water is to be of an application rate and duration such that the water content in the growing medium reaches field capacity to the full depth of the growing medium. The next application is to take place when the water content reaches 25% of field capacity.

Weed, Insect and Disease Control: Grass areas are to be reviewed each time they are mowed for weeds, insect pests, and diseases, and are to be promptly treated when necessary by appropriate mechanical methods. Chemical weed controls are not permitted in City projects.

Broad-leaved weeds are to be removed in Class 1 and 2 lawns if the weed population exceeds 10 broadleaf weeds or 50 annual weeds or weedy grasses per 40 m². This removal is to reduce the weed population to zero.

Fertilizing: Fertilizer application times in the Yukon can be highly weather dependent. In June/July (depending on time of turf installation), an 18-6-12 sulphur-coated urea fertilizer or approved alternate is to be applied to all lawn and grass areas at the rate of 1 kg per 40 m² of grass.

In late August/early September, 3-15-6 winterizer fertilizer or approved alternate is to be applied to all lawn and grass areas. Fertilizers are to be thoroughly watered in after application. Alternate fertilizer formulations and application rates must have the prior approval of the Engineer.

Mowing and Trimming: Classes of lawn or grass referred to herein are as defined in Section 3.22.2.2.

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Class 1 areas: Mow with a sharp reel or rotary mower when the grass reaches a height of 60 mm. Mow to a height of 40 mm. Trim with nylon line type power trimmer. Excess grass clippings are to be removed after each cut.

Class 2 areas: Mow with a sharp reel or rotary mower when the grass reaches a height of 60 mm. Mow to a height of 40 mm. Trim with nylon line type power trimmer. Excess grass clippings are to be removed after each cut.

Class 3 areas: Mow every 30 days or as otherwise required. No edging or trimming is required. Grass clippings do not have to be removed unless the quantity of clippings is such that it may impact growth.

Edging: Class 1 and 2 areas are to be edged with a half-moon or power edger as frequently as necessary to accurately establish and maintain the intended edge location, not less than once per year. Edging should be to lines established and maintained with straight string lines, radiused curves established by string or other marking methods suited to the design layout.

Aeration: Aeration is to not be carried out in the first growing season. If necessary in established turf areas within the project area, aeration is to be done in early June with a suitable mechanical corer. Coring is to be done to a depth of 100 mm, and the cores are to be broken up on the surface by the use of a diamond wire or wood drag.

Repairs: Re-seeding or re-sodding is to be carried out when necessary to restore damaged or failing grass areas. Where lawn fails due to conditions that cannot be modified (such as deep shade or heavy foot traffic) and would result in subsequent failure of lawn if reseeded, other solutions should be sought.

New sod or seed is to match the grass varieties in the surrounding area if growing conditions permit. Resodding may be carried out throughout the growing season. Reseeding should be done during calm weather and on soil that is free from frost, snow, and standing water, when seasonal conditions are likely to ensure successful germination and continued growth of all varieties of seed in the grass mix.

Reseeded areas are to be protected and kept moist until the first mowing.

3.22.5.5.2 Plant Material Establishment

Watering: During the first growing season, new plants are to be watered at least every 3 to 5 days between June 1st and August 31st, and as needed between September 1st and September 15th.

Watering is to be such that the water penetrates the full depth of the growing medium. Soil moisture is to be monitored during the growing season, and watering is to be done more frequently when plants are reaching the permanent wilting point. Scheduled applications of water is to be missed only when rainfall has penetrated the soil fully as required.

Mulch: Mulches are to be maintained in the original areas and to the original depths.

Weed Control: All areas are to have all weeds removed at least once per month during the growing season by hoeing or cultivation to a maximum depth of 80 mm, hand pulling, or other mechanical

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means. Chemical weed controls are not permitted on City projects. Shallow rooted plant material and ground cover areas should have weeds removed only by hand pulling.

Pest and Disease Control: All planted areas are to be reviewed for pests and diseases periodically and at least every two months during the growing season. Treatment for pests or diseases is to be carried out promptly and consistently for maximum effectiveness. The principles of Integrated Pest Management (IPM) should be applied in controlling pests and diseases, that is, methods used should be a combination of physical, cultural, biological and chemical methods chosen for the most effective, safe and economical control of pests and diseases. All pest and disease control procedures must have the prior approval of the Engineer.

Tree Support: Stakes, guy wires and ties are to be maintained for two full growing seasons. Ties are to be checked at least every four months to ensure that they are not causing a depression in the bark, and are to be loosened, repaired or replaced as necessary. All stakes, guy wires and ties on the tree and the rootball, are to be removed after the second growing season except where large trees require continuing support.

Pruning: All trees and shrubs are to be reviewed at least every two months during the growing season and are to be pruned to remove all dead, weak or diseased wood. Clipping or shaping is to be carried out only if required in the maintenance contract for specific varieties or conditions.

Fertilizing: Shrubs and trees are to be fertilized only as required to correct symptoms of nutrient deficiency, except as otherwise recommended on the basis of soil test results. Ground covers are to be fertilized in spring by a uniform application of an appropriate granular at the manufacturer's recommended rate, followed by thorough watering.

3.22.5.6 PROTECTION OF EXISTING TREES

This section covers the requirements for the protection of existing trees, within and adjacent to the construction area, from damage during the course of construction. The work involved is to meet all protective zone requirements, and include strapping of trunks, pruning of roots, pruning of limbs, excavation and backfill requirements.

3.22.5.6.1 Maximum Transplantable Size

An existing tree is to be considered to be larger than the maximum transplantable size when its trunk is greater than 100 mm in diameter as measured at a point 300 mm above the ground.

3.22.5.6.2 Approvals

The Engineer is to approve all materials used for tree protection before any construction is undertaken.

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3.22.5.6.3 Protective Fencing

Protective fencing to consist of snow fencing of a minimum 1.2 m in height. All fencing is to be in good repair – torn or otherwise damaged fencing is not acceptable. Fencing to be secured using t-bar stakes or other suitable posts.

3.22.5.6.4 Strapping Material

Strapping required for the protection of the trunks of existing trees is to consist of wood slat snow fencing or wood planks with a minimum size of 25 mm x 150 mm x 2440 mm.

3.22.5.6.5 Trees Requiring Protection

The Contractor is to undertake all protective measures for trees, beyond the maximum transplantable size, as indicated on the drawings and as specified herein. Trees less than the maximum transplantable size are to be protected similarly or relocated as directed by the Engineer.

3.22.5.6.6 Identification and Removal

Prior to the award of contract, the Engineer will have identified all those trees that may be impacted by the construction activities associated with the project and all such trees will have been inspected and examined by the Parks and Recreation Department.

3.22.5.6.7 Minimum Protective Zone

Existing trees located within the construction area are to have a minimum 2.0 m radius protective zone calculated from the circumference at the base of the trunk which will remain free of excavation, trenching, grade changes, stock piling of materials and soil compaction throughout the duration of the contract. Protective zone requirements are to be as outlined in Table 3.22.4.6.7.

TABLE 3.22.4.6.7
TREE PROTECTIVE ZONES

Trunk Diameter		Minimum Protective Zone Around Tree	
cm	in	Distance from trunk (meters)	Total Diameter (meters)
20	8	2.00	4.20
25	10	2.00	4.25
30	12	2.00	4.30
35	14	2.10	4.55
40	16	2.40	5.20
45	18	2.70	5.85

Modifications to the minimum protection zone are necessary when underground utilities, pavement, curbs, sidewalks and street hardware such as fire hydrants and light poles occur within the protective zone area. Protective fencing is to be installed around these areas.

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3.22.5.6.8 Strapping of Tree Trunks

Trees, beyond transplantable size, involved within, and immediately adjacent to, proposed construction areas are to require strapping, or a double wrap of wood slat snow fencing, or other suitable wood planks strapped to the tree trunk to completely protect the tree trunk from impact damage.

3.22.5.6.9 Excavation and Backfill at the Base of Trees

Excavation and backfill is to be in accordance with standard specifications. In addition, auguring under existing trees will be the recommended method of underground installations. Open trenches at the base of trees are not acceptable. Destroying roots within an area closer than 2.0 m of the trunk face may make the tree structurally unsound. Any excavation within the protection zone must be approved in writing by the Engineer and must be done by hand.

Excavated areas, holes, shafts and trenches associated with construction efforts, and involving exposed roots from adjacent trees, are to be kept moist in order to prevent root desiccation. Shading is acceptable where water use is unsafe.

Backfilling within the protection zone to a depth of 300 mm of the finished grade is to be with a 1:1:1 soil mix of soil, sand and peat moss to allow for proper root regeneration.

3.22.5.6.10 Root Pruning

In the event of major reconstruction efforts, the Contractor is to root prune along the length of the work in an approved manner, such as with a trencher or chain saw. A clean severance of the root system is required. The depth of the cut is to be the same depth as the excavation at the maximum distance from the tree trunk allowed by the construction.

3.22.5.6.11 Limb and Branch Protection

Tree limbs and branches overhanging the construction area are not to be damaged and the responsibility to ensure that the above ground portions of trees are not damaged is that of the Contractor involved in the work. All tree pruning work must be performed according to the directions of an International Society of Arboriculture (ISA) Certified Arborist or other qualified individual as identified by the Engineer.

3.22.5.6.12 Remedial Repair Work to Trees

During the course of construction, the Contractor is to inform the Engineer of any significant damage to a tree. The Contractor can perform all remedial work necessary to repair a tree to the satisfaction of the Engineer and Parks and Recreation staff. Where damage warrants, the City may require an assessment and/or repair by an ISA Certified Arborist.

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3.22.5.6.13 Tree Mortality Cost Assessment for Removal and Disposal

Tree mortality will incur removal and disposal costs which are to be determined by size, tree replacement cost, market price of the largest transplantable tree of the same species and/or may include the appraised value as determined by the current International Society of Arboriculture evaluation procedure or other standards currently used by the Parks and Recreation Department.

3.22.5.6.14 Final Inspection

Upon substantial completion of the contract where trees have been damaged, and prior to the payment of the Final Progress Payment Certificate, the Engineer is to arrange for a final inspection of all trees on the project with Parks and Recreation staff and/or an ISA Certified Arborist and the Contractor. Damage to trees is to be rectified as indicated previously.

All repair/replacement monies due to the City of Whitehorse, as a result of tree damage by the Contractor, will be deducted from the Contractor's Final Progress Payment Certificate.

3.22.5.7 GRASS MAINTENANCE BEFORE ACCEPTANCE

Maintenance for seeded and sodded areas is to begin immediately after sod has been installed or seeding has been completed, and is to continue until the date set for turning the areas over to the City for further maintenance.

Maintenance is to include all measures necessary to establish and maintain grass in a vigorous growing condition, including, but not limited to the following:

- Mowing of Class 1 & 2 areas is to be carried out at regular intervals as required to maintain grass at a maximum height of 75 mm. Not more than $\frac{1}{3}$ of the blade is to be cut at anyone mowing. Edges of sodded and seeded areas are to be neatly trimmed. Heavy clippings are to be removed immediately after mowing and trimming.
- Top dressing and rolling to repair ruts.
- Watering is to be carried out when required and with sufficient quantities to prevent grass and underlying soil from drying out.
- Weed control in Class 1 & 2 areas is to be carried out when the density of weeds reaches 25 broadleaf weeds per 100 m².
- Weed control is to reduce the density of weeds to zero. Weeds are to be removed by mechanical means only; chemical weed control is not permitted on City projects.
- Any sodded or seeded areas that show deterioration or bare spots are to be repaired immediately. All sodded areas showing shrinkage due to lack of watering are to be top-dressed and seeded with a seed mix that matches the original seed mix, when conditions allow.

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All seeded and sodded areas are to be adequately protected with warning signs, temporary wire or twine fences, or other necessary means. Fencing is to be maintained in good condition to provide a continuous barrier until Acceptance. Except as otherwise required by the contract or as otherwise agreed, fencing is to be removed from the site upon Acceptance.

In areas where sod fails to grow, for whatever reason, the Developer is to remove the dead sod and replace it according to Section 3.22.3.9.

The maintenance of all turf is to commence immediately after sodding or seeding and is to continue until the date of acceptance by the Engineer.

3.22.5.8 RECOMMENDED CONDITIONS FOR ACCEPTANCE OF GRASSED AREAS

Acceptance of grass areas by the Engineer and the City for further maintenance should be done only when the following conditions exist:

1. Growing medium quality, fertility levels, depths and surface conditions are as specified;
2. Grasses are the required species, free of species other than those specified.;
3. Class 1 & 2 grassed areas are relatively free of weeds, containing no more than 5 broadleaf weeds or 25 annual weeds or weedy grasses per 100 m²;
4. Sod is sufficiently established that its roots are growing into the underlying growing medium;
5. Sodded areas have been mown at least once, to a height of 75 mm;
6. Seeded areas have been mown at least twice, to a height of 75 mm, the last mowing being within 48 hours of the field review for Acceptance; and
7. Grasses are to be established in sufficient density that no surface soil will be visible when they are mown to a height of 75 mm.
8. Maintenance procedures set out in Section 3.22.4.7 have been carried out.

For seeding in Class 3 areas - the developer is to warrantee the work for two years. Prior to seeding the Developer and Engineer will agree on the purpose of seeding, either erosion protection or aesthetics (in more stable soils).

In the first year, an inspection is to be completed to review initial germination. Any areas containing less than 100 plants per square meter are to be reseeded.

In the second year, during the Final Acceptance Inspection any areas containing less than 50 plants per square meter are to be reseeded. In areas of highly erodable materials up to two re-seedings may be required from the developer before FAC is issued. In areas with more stable soil only one seeding will be required for the FAC.

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3.22.5.9 TREE PRUNING

The primary reasons to prune trees are to improve trunk and branch structure, to remove or shorten low limbs for under-clearance, to thin the canopy to allow better airflow, and to maintain tree health. Although there are aesthetic concerns, the appearance of the trees will be secondary to health and structural concerns. The single greatest structural concern is the large number of co dominant trunks or main leaders. Pruning of newly planted shrubs will be undertaken only to remove dead, damaged or diseased material or to correct substantial defects in form.

3.22.5.9.1 Extent of Pruning

The specified pruning may require the removal of up to 30% of the foliage in many instances. Under no circumstances are more than 40% of the foliage from an individual tree to be removed.

Other than when shortening limbs for clearance over roadways or sidewalks, removal of live limbs smaller than 25 mm in diameter on the interior of the canopy will not be required. This is discouraged and is considered unnecessary. Removal of dead limbs or stubs 25 mm in diameter or larger will be required.

All pruning is to be done according to the guidelines of the International Society of Arboriculture (ISA). Work is to be done by staff trained in proper techniques. Substantial pruning must have the prior approval of the Engineer.

3.22.5.9.2 Co dominant Leaders and Stems

Due to the recognized potential hazards associated with co dominant leaders, the subordination (shortening using a drop-crotch cut) or removal of one side of a co dominant leader is the primary objective. Branches, trunks, or leaders not considered the main leader, 50 mm diameter or larger should be subordinated or removed. The main leader is to is not to be subordinated or removed.

Co dominant leaders are considered to be two or more branches, trunks, or leaders of approximately the same size, originating in close proximity to one another. If there is no stem considerably larger than others, subordinate all but one branch, which will become the leader. Where there is included bark as part of the condition, preference should be given to the removal of one side, but only if such removal will not destroy the aesthetic value of the canopy or remove more than 40% of the foliage.

3.22.5.9.3 Developing Main Branches

On trees 4.5 m or taller, identify some of the main limbs (called scaffold branches) on the tree that will remain on the tree permanently. Scaffold limbs should not have bark inclusions in the crotch. Ideally, these main limbs should be positioned more-or-less radially around the trunk with no scaffold branch directly above another.

Scaffold branches should not be opposite one another; and should be spaced about 45 – 90 cm inches apart along the main trunk, distributing the weight over a number of well-positioned scaffold branches. Many trees will not grow in this manner on their own and this form will need to be encouraged by

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reducing the length of, or removing, branches between the scaffold branches. Remaining branches will grow faster and these faster growing branches will become the scaffold branches.

3.22.5.9.4 Crown Raising or Lifting

Branches over paved areas should be shortened or removed to allow approximately 2.5 m of clearance for vehicles as practical. Over landscape areas and sidewalks they should also be shortened or removed to allow 2.5 m for pedestrian traffic and utility use as practical. Shortening of branches is the preferred method for attaining adequate clearance. When pruning is completed, approximately one-half of the foliage should originate from branches on the lower two-thirds of each tree.

3.22.5.9.5 Thinning

Although small diameter limbs may be pruned where the Contractor desires, it will not be necessary to make cuts smaller than 25 mm in diameter, other than where branches may be shortened to accommodate clearance beneath the canopy.

Thinning is to include the following: remove dead or broken limbs 25 mm in diameter or larger; if two limbs are crossing or touch each other, shorten or remove one of them; if two limbs (25 mm diameter or larger) originate within 30 cm of each other on the trunk, shorten or remove one of them. Clearance from buildings, lights, or other structures should be a minimum of 1 m or as practical. Use directional pruning where possible so future growth is directed away from buildings and lights.

3.22.6 IRRIGATION

This section deals with the design, installation and commissioning of a properly operating irrigation system to cover the applicable landscape. The work includes: design and documentation of the proposed irrigation system; review of the proposed irrigation design by City Staff and the Consultant; amendments to the design as required by the City or the Consultant; supply and installation of all materials and components necessary for a fully and properly functioning automatic irrigation system to the standards and satisfaction of the City; and final hook-up, pressurization and testing. Connection to the main water supply will be done by the City.

The following standards for Landscape Irrigation Systems have been developed by the City of Whitehorse to reflect the current minimum standard for municipal installations and to provide guidance as a benchmark for performance. The principles embodied in these standards apply to all irrigation systems but the special circumstances of some installations may require the development of more customized specifications related to the project. The use of these standards is intended to encourage good water management through the design and installation of irrigation systems in accordance with accepted industry practice. Please note that the City of Whitehorse typically uses Rain Bird irrigation equipment and Watts backflow preventers.

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3.22.6.1 QUALITY ASSURANCE

A suitably experienced and qualified contractor, having trained and competent personnel adequate for the scope of work is to do all irrigation work.

A written guarantee of the installed system is to be provided to the City covering workmanship and materials for a minimum of one year from date of final acceptance.

3.22.6.2 SUBMITTALS

Suitably scaled design and Record Drawings are to be provided (these should be the same scale as the project design drawings). All components of the irrigation system are to be shown, with clear measurements from an identifiable reference point to the location of the controller and its circuit breaker, master valve, zone control valves, main water connection, blowout connection, pump and its electrical connections, and any other similar features.

Provide a manual containing operating and maintenance instructions for all components of the system.

Provide clear instructions for operating the irrigation system "in season", showing the relative timing differences between zones of different precipitation rates, and a schedule of run times suggested for various weather conditions.

Provide any special tools as provided by the manufacturer for day-to-day servicing of the irrigation equipment installed.

3.22.6.3 SITE CONDITIONS

Verify and mark the location of all site elements and utilities that affect the irrigation system.

Verify and mark the location of all buried cables, conduits, pipes, etc., prior to any trenching.

Adjust the design as necessary, together with the City's representative and in accordance with requirements of Section 2.8, to suit existing site conditions and grade before proceeding with the work.

Protect from damage as necessary, existing landscape features, plant material, structures, work in progress, and the work of other trades.

Ensure that sequencing of this work is carried out in coordination with the work of other trades and that sleeves are installed when appropriate.

3.22.6.4 OWNER (CITY) OR REPRESENTATIVE

Prior to commencement of any involvement with an irrigation project, identify the person or persons properly authorized to make project decisions. This may be any combination of the Consultant and/or relevant City Staff from the Departments of Engineering and Parks and Recreation, particularly the Parks Lead Hand.

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3.22.6.5 REGULATIONS

Obtain all permits and licenses applicable to the work to be done.

Ensure that there is compliance with all relevant codes and regulations both in the design and during installation.

3.22.6.6 ALTERNATE MATERIALS

Obtain written approval from the City prior to using materials that are different from those shown in the design.

Alternate materials must match the original materials in performance, flow, pressure loss, and other important characteristics so as not to compromise the intent of the design.

The materials must all remain compatible.

The alternate materials proposed must be installed according to manufacturer's recommendations.

3.22.6.7 MATERIALS

3.22.6.7.1 Sprinklers

All sprinklers are to be in new condition with the size, manufacturer, and features shown in the design, or approved equal.

The relevant manufacturer's recommendations must be followed in the selection and application of each sprinkler being used.

3.22.6.7.2 Control Valves

All control valves are to be in new condition with the size, manufacturer, and features shown in the design, or approved equal.

The relevant manufacturer's recommendations must be followed in the selection and application of each control valve being used.

Valves are not permitted to be installed in pathways.

3.22.6.7.3 Isolation Valves

All isolation valves are to be in new condition with the size, manufacturer, and features shown in the design, or approved equal.

Valves 1/2" (12.5 mm) through 2¹/₂" (63.5 mm) may be ball or gate valves while those larger are to be gear operated butterfly valves.

Valves are not permitted to be installed in pathways.

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3.22.6.7.3 Controllers

All controllers are to be in new condition with the size, manufacturer, and features shown in the design or approved equal.

All controllers are to be CSA approved for use in the mounting location selected.

3.22.6.7.4 Wire

All power and control wiring and its associated components are to conform to local codes being used.

All wire is to be sized and specified as shown in the design.

Power wire is to be CSA approved for NMWU or TWU for direct bury.

Single conductor control wire is to be CSA approved TWU.

White wire is to only and always be used as the common wire.

All connectors are to be CSA approved for watertight application and installed according to the manufacturers recommendations.

3.22.6.7.5 Backflow Prevention Devices

All backflow prevention devices are to be in new condition with the size, manufacturer, and features shown in the design, or approved equal. The City of Whitehorse typically uses Watts backflow preventers.

All devices used must be CSA approved for the application and must meet or exceed the local plumbing requirements.

3.22.6.7.6 Pipe

3.22.6.7.6.1 Polyethylene

All pipes are to be in new condition, extruded from virgin materials and continuously and permanently marked with the manufacturers name, material, size, and pressure rating.

All pipes must be Series rated for a pressure equal to or greater than the maximum water pressure to be encountered in the irrigation system. Schedule 40 pipe is preferred.

3.22.5.8.7.2 Poly Vinyl Chloride (PVC)

All pipes are to be in new condition, extruded from virgin materials and continuously and permanently marked with the manufacturers name, material, size, and pressure rating.

Series 315 pipe is to be used in 1/2" (12.5 mm), series 200 in 3/4" (19 mm), and series 160 in 1 1/4" (32 mm) and larger.

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3.22.6.7.7 Fittings

Fittings for PVC pipe are to be minimum Schedule 40 PVC suitable for solvent welding or threaded connections.

Fittings for Polyethylene pipe may be compression style or insert fittings with a strength at least equal to the pipe used, complete with stainless steel clamps. Use only fittings recommended by the pipe manufacturer

Nipples are to be Schedule 80.

3.22.6.7.8 Cement and Primer

The cement and primer combination is to be as recommended by the manufacturer to be suitable for the materials and application, and be used according to manufacturer specifications.

3.22.6.7.9 Valve Boxes

All valve boxes are to be in new condition of the size and type as shown in the design or approved equal.

Valve boxes are not permitted to be installed in pathways.

3.22.6.7.10 Sleeving

Sleeving material is to be Series minimum 160 PVC unless otherwise specified.

Sleeving is to be twice the size of the pipe being protected if lateral line and three times the size if main line.

3.22.6.7.11 Hydraulic Controls

Hydraulic control lines and the associated water filtration equipment is to be as recommended by the manufacturer of the control devices being used.

3.22.6.8 INSTALLATION

Prior to installation, the exact location of lines, valves, and heads must be coordinated with planting locations to avoid conflict and damage during the course of the work. All sprinkler locations are to be staked and grades checked for all components.

3.22.6.8.1 Excavation and Backfill

The following coverage to finished grade is required over the piping. Depths over piping may be greater dependent on site conditions and use.

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Table 5-1: MINIMUM COVERAGE DEPTHS OVER PIPING	
Commercial/Institutional Landscape	200 to 300 mm
Public Parks and Sports Fields	300 to 400 mm
Sleeving under Roadways	450 to 600 mm
Sleeving in Landscape	150 to 200 mm
Piping on Slab	If required depth is not available, pipe is to be on top of the filter fabric above the drain rock or voiding material

All trenches are to be as straight as possible with a level, uniform grade to the bottom.

Backfill trenches in 100 mm layers, tamping firmly to ensure that the compaction of the trench is equal to the surrounding undisturbed areas.

Backfill material is to be free of rocks and/or other unsuitable materials, which could damage the pipe or create unusual settlement problems

Backfill material around the swing joints and under the heads are to be of a suitable type so as to allow appropriate movement under impact.

Trenches are to be at least 300 mm away from paving stone or other hard surfaces to avoid undermining such surface or its edge retention.

There is to be no excavations undertaken within 1.0 m of any underground utility cables unless:

- The excavation is done under the control of the operator of the utility system; or
- The excavation method is approved by the Utility.

In the event mechanical tree digging equipment cannot maintain a minimum clearance of 1.0 m from shallow utilities during installation, the pertinent Utility must be contacted for approval and/or safety procedures. Any additional costs incurred will be at the Developer’s expense.

3.22.6.8.2 Pipe

Visually inspect each pipe prior to installation, removing any dimpled or otherwise damaged sections.

Lay the pipe in a straight line between fittings, placing it on firm soil at all points in the trench.

Multiple pipes may occupy the same trench provided that a minimum of 50mm (2”) horizontal clearance can be maintained and the pipes are all on the same plane.

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All solvent welding is to be done in careful compliance with the manufacturer recommendations with particular attention to cleanliness, air temperature, moisture, and curing time. Excess cement must be removed from all joints

All polyethylene insert fittings in 1½" (38 mm) and 2" (50 mm) sizes are to be double clamped.

Thrust blocking is required for gasketed pipe 3" (75 mm) and larger.

As the pipe layout in the design is diagrammatic, care must be taken during the installation to size the pipe to keep the velocity of flow at less than 5 f/s.

Place all pipe, fittings, valves, and other equipment carefully in trenches. Ensure interiors of pipes are free of dirt and debris.

Install all plastic pipe as per manufacturer’s recommendations.

3.22.6.8.3 Valves and Valve Boxes

All valve boxes are to be installed flush with finished grade and located in shrub areas where possible.

All valves are to be installed vertically and centered in the box so as to be easily accessible for servicing.

All valve boxes are to be installed with adequate clearance above the pipe and on a firm base so as not to contact the pipe with settlement or upon being depressed.

Valve boxes are to be supported on a type of material able to support the weight of expected traffic. Place minimum 100 mm drain gravel under base, compact to 95% modified proctor density. Top of box to meet finish grade.

Minimum valve box size recommendations are:	
910	One 1½" (38 mm) or Two 1" (25 mm) valves
1419	Two 1½" (38 mm) or Three 1" (25 mm) valves
1320	Three 1½" (38 mm) or Four 1" (25 mm) valves

3.22.6.8.4 Sprinklers

An adjustable swing joint assembly that is sized to meet the flow requirements of the sprinkler is to connect all pop-up sprinklers to the pipe.

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A swing joint assembly is to be either a PVC triple swing joint consisting of a Schedule 40 street elbow (MIPT x FIPT), a Schedule 80 nipple, and two Schedule 40 street elbows at the head end; or a polyethylene swing pipe with a barb by pipe thread elbow at each end.

All sprinklers with an inlet size larger than $\frac{3}{4}$ " (19 mm) are to use a PVC triple swing joint assembly or a pre-assembled swing joint only.

Swing joint assemblies for valve-in-head sprinklers are to have ACME threads and a O-ring sealing mechanism.

The bottom street elbow of the swing joint assembly is to be connected to an outlet on the side of the lateral line pipe and the nipple is to be of sufficient length to be installed at an approximate 45-degree angle when the sprinkler is mounted at finished grade. A similar alignment is required if swing pipe is used with a minimum length of polyethylene tubing of 12" (305 mm).

All pop-up sprinklers are to be installed flush and level with the finished grade and not higher than any adjoining hard surface from which there must be at least a 50 mm (2") separation to allow for edging.

All stationary shrub risers are to be installed with two PVC street elbows connected to the side of the lateral line pipe and a Schedule 80 nipple that is long enough to suit the plant material.

All piping must be thoroughly flushed prior to the installation of sprinklers and nozzles, which on large zones will require progressive flushing.

3.22.6.8.5 Wire

All wiring is to be installed to meet local electrical codes.

All wiring is to be protected by being bundled and taped at 3 m (10') intervals and installed beneath the irrigation piping or in appropriately sized conduit if run independently.

All wire splices must be contained in a valve box.

Sufficient extra wire is to be left in each valve box so that the splice may be lifted 30 cm (12") above grade; such extra wire is to be neatly coiled.

White wire is to only be used as the common wire and other colours used is to be consistent from valve to controller.

3.22.6.8.6 Backflow Prevention

Backflow prevention assemblies are to be installed according to the local plumbing code and City Standards.

All cross connection control devices installed must be sized to accommodate the flow requirements present and successfully tested by the City after installation.

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3.22.6.8.7 Controller

The controller is to be firmly mounted at approximate eye level with all wiring done in the controller or an approved junction box.

Zones are to be wired in a logical sequence and unless they can be clearly described, a scaled site plan is to be mounted next to the controller with each zone clearly outlined.

The installation of any rain/moisture sensing equipment is to be noted on the controller and the location of the controllers circuit breaker indicated unless obvious.

3.22.6.8.8 Turf Valve / Quick Coupling Valves

All turf valves installed in the landscape are to be securely mounted and supported according to manufacturer recommendations and project specifications.

3.22.6.8.9 Sleeving

All sleeving in soil is to be installed and backfilled with the same considerations for protection of the material as if it were water pipe. Compaction is to be to the same standard as the adjoining undisturbed soil and the sleeves are to project at least 30 cm (12”) on either side of the hard surface being crossed.

Sleeving being installed across roads or driveways for later use are to have the necessary pipe installed at the same time with each end elbowing to at least 60 cm (24”) above grade. Flag ends for increased visibility and safety.

When it is not possible to install sleeving, the water pipe is to be either Schedule 40 PVC or Series 160 Polyethylene.

3.22.6.8.10 Site Maintenance

The job site is to be kept in a neat, clean, and orderly condition at all times during the installation process.

All scrap and excess materials are to be regularly removed from the site and properly disposed of.

Trenching, laying pipe, and backfilling are to be continuous so that the amount of open trench at the end of each workday is minimized. Any open trench or other excavations are to be barricaded and marked with high visibility flagging tape.

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3.22.6.9 INSPECTION AND TESTING

3.22.6.9.1 Inspection

Upon completion of the irrigation system installation, all pressure regulation, arcs, distances of throw, sprinkler locations and height, controller zones, etc., must be adjusted so as to optimize the operation of the system and make it ready for inspection and testing.

The City's representative to ensure that the work has been completed according to specifications, and meets the intent of the installation standards will carry out inspection.

3.22.6.9.2 Testing

The test will require that the system be operated sequentially with the controller, in the presence of the City's representative.

The purpose of the test is to ensure that the system adequately covers the landscape to be irrigated and meets the design criteria.

3.22.6.9.3 Deficiencies

Any deficiencies noted during the inspection and testing will be rectified promptly and signed off by the City's representative.

3.22.7 CLEANUP

Cleanup of abutting roadways is to be a continuous operation. At no time is topsoil or debris of any kind to be allowed to remain on roadways overnight.

3.22.8 GROWING SEASON

Grass planting is not to be performed before June 1st or after September 15th.

Sod laying is not to be performed before June 1st or after September 15th. Sod laying on slopes steeper than 3:1 is not to be performed when the temperature is above 23° C.

Trees, shrubs, and perennials are to not be planted before June 1st or after October 15th weather dependent.